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Research Article

The Trichoptera of Panama. XXVI. Status of the genus *Protoptila* (Trichoptera, Glossosomatidae)

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Abstract

The caddisfly genus *Protoptila* (Trichoptera, Glossosomatidae) in Panama is currently represented by 15 species, including four endemic species and 11 species also found in Costa Rica. The shared occurrences of Panamanian species with other countries in the region are minimal. Herein, we describe and illustrate a new species, *Protoptila harrisi* **sp. nov.**, and add one new country record, *Protoptila bribri* Holzenthal & Blahnik, 2006. These additions are the result of several projects conducted by the Aquatic Invertebrate Research Group at the Universidad Autónoma de Chiriquí. The Republic of Panama now has 17 species of *Protoptila* and 535 species of caddisflies distributed among 15 families and 56 genera.

Key words: Biological diversity, caddisfly, geographic distribution, Neotropics

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Introduction

The Aquatic Invertebrate Research Group (AIRG) at the Universidad Autónoma de Chiriquí (UNACHI) and its Museo de Peces de Agua Dulce e Invertebrados (MUPADI) is currently focused on increasing our knowledge of aquatic invertebrates in Panama. Toward that goal, it has secured registered projects for initial examination of the Trichoptera and Plecoptera in western Panama. Current AIRG and MUPADI personnel have also been involved in extramural projects involving aquatic insects in Panama. One such project is the "Proyecto de Sistema de Producción Sostenible Conservación de la Biodiversidad (PSPSCB)" which was managed by the Panamanian Ministry of the Environment (MiAmbiente) and funded by the World Bank. Some current AIRG and MUPADI personnel were involved with the PSPSCB project throughout. The information provided in this paper resulted from both AIRG projects and PSPSCB.

The genus *Protoptila* Banks, 1904 (Trichoptera, Glossosomatidae) is the second most diverse genus in the subfamily Protoptilinae with 90 described species. The genus is distributed from North and South America (Holzenthal and Calor 2017; Blahnik and Armitage 2019). The fauna of caddisflies of the genus *Protoptila* in Panama is represented by 15 species, four of which are endemic to the country (Blahnik and Armitage 2019). In this paper, we describe one new species of *Protoptila* and add one new country record.

Materials and methods

Study areas

The Bosque Protector Palo Seco (BPPS) has an area of ~254,446 hectares. It serves as a conservation corridor linking La Amistad International Park in Costa Rica and Panama with Fortuna Forest Reserve to the east in Chiriqui Province. In Panama, it occupies large portions of Bocas del Toro Province and the Comarca Ngöbe-Buglé. The BPPS is made up of three large drainages and their respective tributaries: to the north, the Río Aguas Blancas and Río Yorkin, tributaries of the Río Sixaola; to the center, the Río Teribe and its tributaries, and to the southeast, the Río Changuinola, with its tributaries, such as the Río Riscó and other rivers that flow into the Chiriquí Lagoon, such as the Río Uyama and Río Róbalo. The BPPS is framed in the oceanic tropical climate. The annual temperature averages oscillate between 25 °C and 27 °C. The relative humidity is always high, 84.5% as an annual average, and the wettest month is June. Precipitation totals are high, reaching 2,513 mm in the strip that goes from the southern Río Teribe to the southern Río Changuinola (ANAM 2006).

The Río Chiriquí Viejo drainage (Cuenca 102) is one of 52 major drainages in Panama, located on Panama's western border with Costa Rica. This watershed encompasses 1,352.2 km^2 (~522 mi^2) in Chiriquí Province, with the primary river having a length of 161 km (~100 mi). The river rises near Cerro Punta, NE of Volcán, and runs SW to Plaza de Caisán. From there the river runs parallel to the Costa Rican border, coming within 100 meters from the border line at Paso Canoas, where it turns and runs southeast, joining other major rivers such as the Río Jacú and Río Gariché. The Río Chiriquí Viejo finally flows into Charco Azul Bay (Pacific Ocean), about 15 km east of Puerto Armuelles on Panama's southwestern corner. The watershed is primarily forested, with fincas scattered throughout, and usually with extensive, wooded stream corridors. The watershed is dominated by Volcán Barú in the NE corner, with the northern third part of the Talamanca mountain range, gradually descending to sea level as it meets the Pacific Ocean to the south. Rainfall in this Pacific drainage is less than that experienced in the BPPS.

Study locations and specific collection locations are indicated in Fig. 1. Additional information about the major watersheds of Panama can be found at the Instituto de Meteorología e Hidrología de Panamá website (IMHPA 2023).

Methods

In early 2019, AIRG conducted biweekly sampling in the Bosque Protector Palo Seco (BPPS) located in western Panama, which is part of a set of protected areas in the highlands of the country, including La Amistad International Park, the Fortuna Forest Reserve and the Volcán Barú National Park. Subsequently, in mid-October 2019, a four-day sampling event occurred as part of the PSPSCB project involving BPPS. In 2023, AIRG conducted a monthly study of the aquatic insects of 27 stream locations in the Río Chiriquí Viejo drainage (Cuenca 102), including the Río Caisán referred to below.

Specimens were collected using ultraviolet light traps and Malaise traps. Alcohol pan traps were employed in the BPPS studies and UV-LED bucket traps were employed in the Río Chiriquí Viejo study. The samples were prepared and examined following the standard methods described in Blahnik and Holzenthal

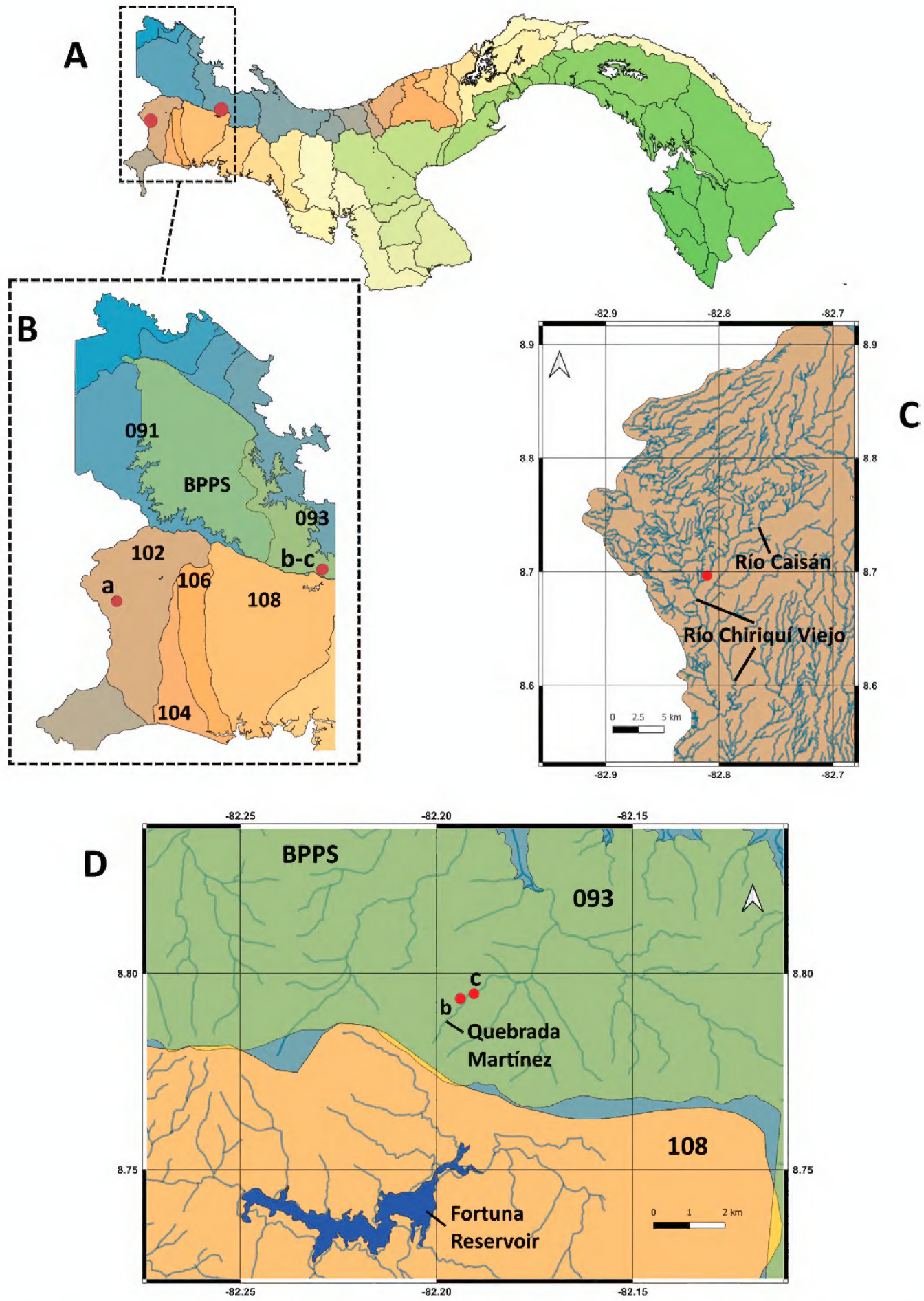

Figure 1. Maps of collection sites **A** map of Panama showing relative collection locations **B** Western Panama showing the BPPS area (shaded in green) and collecting sites **C** Chiriqui Viejo Drainage showing the location of Río Caisán **D** BPPS showing the location of Quebrada Martinéz. [**a**–Río Caisán; **b, c**–Quebrada Martinez; BPPS–Bosque Protector Palo Seco].

(2004). Forewing length was measured from base to apex using a 5 mm microscale (BioQuip Products, Rancho Dominguez, California, USA). Male genitalia were treated with 5% KOH and heat was applied to speed up the clearing process. The cleared genitalia were then rinsed with distilled water and acidified alcohol before being examined under a dissecting scope.

Morphological terminology follows that of Holzenthal and Blahnik (2006) for *Protoptila*. Altitude values are given in meters above sea level (m a.s.l.). Maps were created in QGIS software, version 3.28.5-Firenze. The holotype listed in this publication is deposited in the Universidad de Panamá Museo de Invertebrados (MIUP). Paratypes and other specimens are deposited in MUPADI.

Results

Taxonomy

Order Trichoptera Kirby, 1813
Suborder Integripalpia Martynov, 1924
Superfamily Glossosomatoidea Wallengren, 1891
Family Glossosomatidae Wallengren, 1891
Subfamily Protoptilinae Ross, 1956
Genus *Protoptila* Banks, 1904

***Protoptila harrisi* Blahnik, Aguirre & Armitage, sp. nov.**
https://zoobank.org/23BD9D11-3C5D-4A82-9492-E1CC00223CB1
Fig. 2

Type locality. Panama: Comarca Ngäbe-Buglé, Cuenca 093, Bosque Protector Palo Seco, Quebrada Martínez, Alto del Valle, PSPSCB-BPPS-C093-2019-033; 8.79199°N, 82.19320°W, 520 m a.s.l.

Type specimen. *Holotype*: ♂, in alcohol. Original label: "Panama: Comarca Ngäbe-Buglé, Bosque Protector Palo Seco, Quebrada Martínez, Alto del Valle; PSPSCB-BPPS-C093-2019-033; 8.79199°N, 82.19320°W, 520 m a.s.l., 8–12 Oct. 2019; Y. Aguirre, T. Ríos, and E. Pérez; Malaise trap"; MIUP-022-T-2023. ***Paratype*** • ♂; in alcohol; same as holotype; except, behind the park ranger control post of MiAmbiente; 8.794836°N, 82.190469°W; 480 m a.s.l.; 24 Apr.–8 May 2019; Malaise trap; Y. Aguirre and T. Ríos; MUPADI-016-T-2023.

Diagnosis. The male of *Protoptila harrisi* sp. nov. has a rather simple and relatively unremarkable genitalic structure. In general, it resembles *P. maculata* (Hagen, 1861), *P. palina* Ross, 1941, and some other North American species, in having a lateral lobes of tergum X that are undivided or unjointed and in having relatively simple paramere appendages. However, unlike the North American species, the lateral lobes of tergum X have no indication of basal preanal appendages. Among species from Central America, it probably most closely resembles *P. jolandae* Holzenhal & Blahnik, 2006 from Costa Rica, especially in having relatively elongate and apically tapering lateral lobes of tergum X and in having sternum IX developed into a narrow, projecting process, with a somewhat forked or divided apex. It differs from that species in having longer, more spiral paramere appendages, in the overall shape of the lateral lobes of tergum X and phallus, and in having a shorter and more distinctly apically forked or bifid ventral lobe of sternum VIII. In most of these features *Protoptila* sp. nov. also resembles the more recently described *P. inflata* Blahnik & Armitage, 2019 and *P. totumas* Blahnik & Armitage, 2019, both described from Panama, but these species are morphologically distinctive and are unlikely to be confused with the new species.

Description. Male. Total length of forewing: 2.0 mm. Forewing with forks I, II, and III present; hind wing with fork II only, wing narrow and acute apically, costal margin with pronounced invagination. Spur formula 0:4:4. Overall color (specimens cleared; in alcohol) yellowish-brown. ***Genitalia*** (Fig. 2). Sternum VI process relatively prominent, posteriorly directed, longer than wide, apex subacute. Tergum VIII with a row of elongate setae along posterior margin; sternum VIII moderately densely setose, setae elongate, posterior margin distinctly produced, slightly

curved upward, extending about same length as dorsolateral lobes of tergum X; as viewed ventrally, with ventral projection narrow, shallowly forked apically, apices of fork rounded. Segment IX with anterior margin broadly rounded, sternum mesally produced into short, acute process, posterolateral margin of segment IX with rounded projection dorsally. Preanal appendages absent. Tergum X, as viewed laterally, with lateral lobes not obviously subsegmented, distinctly ventrally deflexed, apical margin of lateral lobe distinctly narrowed, tapered, and acute, dorsal margin between lobes short and continuous, mesally with short membranous lobe; lateral lobes simple, elongate and narrow, downturned, with short apical setae; apex acutely narrowed, projecting nearly straight. Phallobase dorsally with large, laterally compressed apodeme, ventrally with pair of short, rod-like, articulated appendages, appendages fitting into sclerotized pockets on ventral margin of

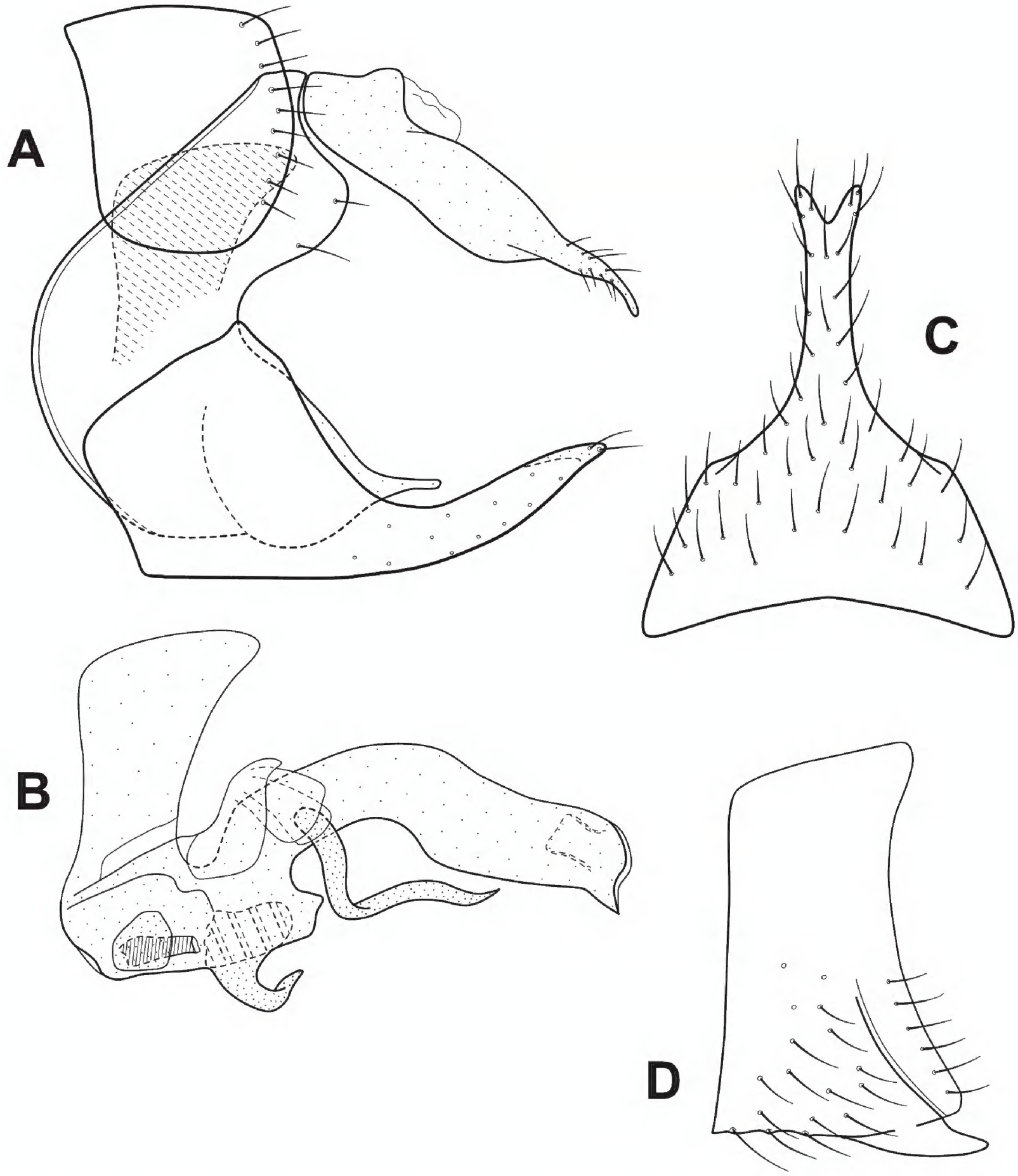

Figure 2. *Protoptila harrisi*, sp. nov., male genitalia **A** lateral (position of phallic apparatus in genital capsule indicated with cross hatches **B** phallic ensemble, lateral **C** sternum VIII, ventral **D** sternum VI, ventral process, lateral.

phallobase, ventral margin of each pocket with short, hook-like projection. Phallicata, as viewed laterally, tubular, fused to phallobase, distinctly arched, slightly widened in apical half, apicoventral margin with short, acute projection; as viewed dorsally, slightly widened apically. Phallotremal sclerite indistinct. Parameres each with "nested" membranous basal structure and relatively short, narrow, sclerotized paramere appendage, appendage with distinct spiral curvature, apex acute.

Distribution. Panama: Comarca Ngäbe-Buglé (Bosque Protector Palo Seco).

Etymology. This species is named for Dr. Steven C. Harris of Pennsylvania Western University in Clarion, Pennsylvania, USA in recognition of his lifetime dedication to aquatic sciences, adult Trichoptera systematics, and, in particular, the taxonomy of microcaddisflies in the Nearctic and Neotropical Regions. The name is a noun in the genitive (possessive) case.

***Protoptila bribri* Holzenthal & Blahnik, 2006, new country record**

Material examined. PANAMA: Chiriquí Province • ♂; in alcohol; Cuenca 102, Renacimiento District, Dominical, Río Caisán, Location C102S18; 8.696632°N, 82.810659°W; 484 m a.s.l.; UV-LED bucket trap; 18 May 2023; Y. Aguirre and T. Ríos; MUPADI. Comarca Ngobe-Buglé • ♂; in alcohol; Cuenca 093, Bosque Protector Palo Seco, Quebrada Martínez, Alto del Valle, behind the park ranger control post of MiAmbiente; 8.794836°N, 82.190469°W; 480 m a.s.l.; 1 Aug. 2019; UV light trap; Y. Aguirre and T. Ríos • ♂; in alcohol; ibid., except; 26 Nov. 2019.

Distribution. Costa Rica, Panama.

Distribution

Table 1 provides a list of *Protoptila* species now known from Panama, as well as their distribution in other countries. The comparative numbers of endemic species and species shared with South America, Mexico, other Central American countries, and Costa Rica are shown in Fig. 3.

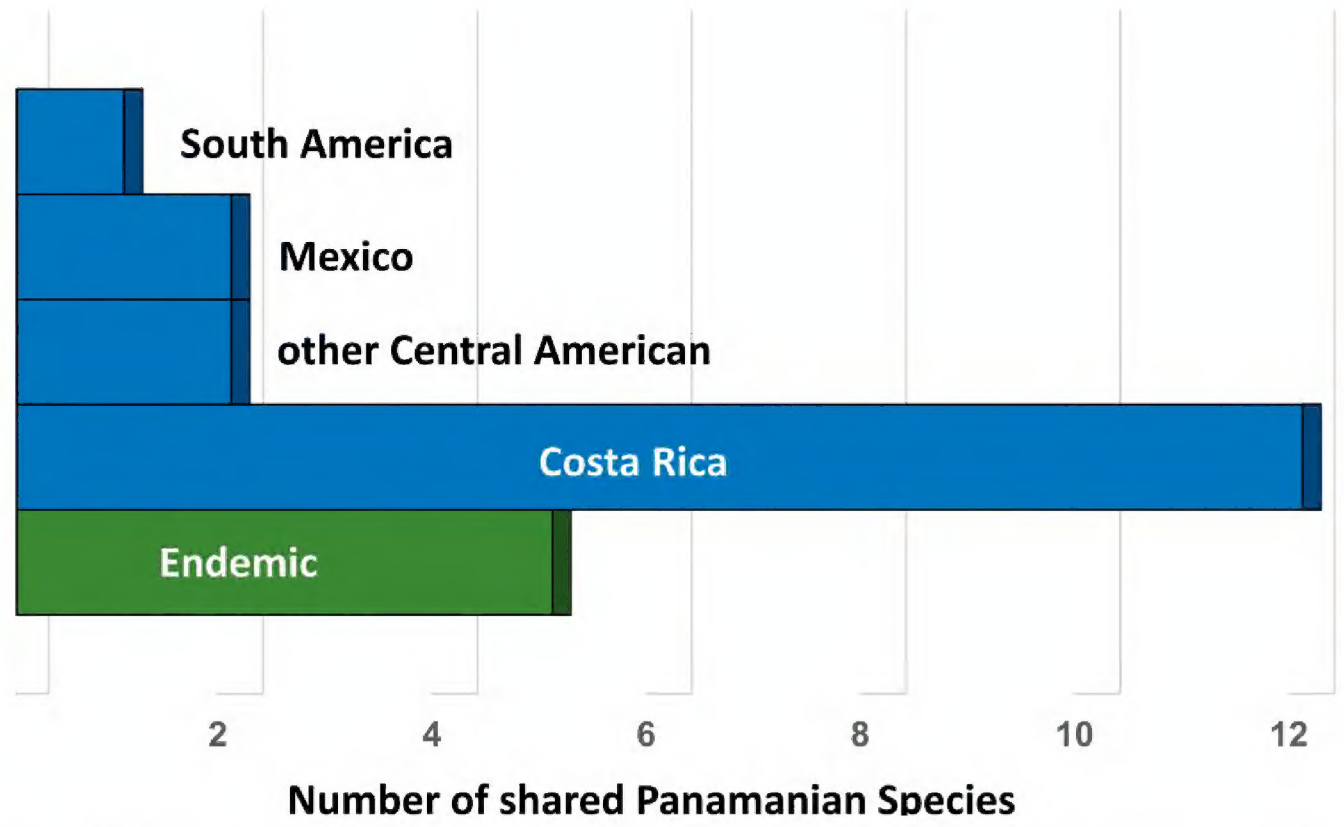

Figure 3. Number of Panamanian species of *Protoptila* shared with other country or regional areas.

Table 1. List of *Protoptila* species with country of holotype and distribution information.

Species [Holotype Country]	Distribution
Suborder Integripalpia Martynov	
Superfamily Glossosomatoidea Wallengren	
Family Glossosomatidae Wallengren	
Protoptila altura Holzenthal & Blahnik, 2006 [Costa Rica]	Costa Rica, Panama
Protoptila bicornuta Flint, 1963 [Honduras]	Belize, Costa Rica, Guatemala, Honduras, Mexico, Nicaragua, Panama
Protoptila boruca Flint ,1974 [Costa Rica]	Costa Rica, Panama
Protoptila bribri Holzenthal & Blahnik, 2006 [Costa Rica]	Costa Rica, Panama
Protoptila cana Flint, 1974 [Costa Rica]	Costa Rica, Panama
Protoptila chitaria Holzenthal & Blahnik, 2006 [Costa Rica]	Costa Rica, Panama
Protoptila harrisi Blahnik, Aguirre, & Armitage, 2023 [Panama]	Panama
Protoptila inflata Blahnik & Armitage, 2019 [Panama]	Panama
Protoptila jolandae Holzenthal & Blahnik, 2006 [Costa Rica]	Costa Rica, Panama
Protoptila laterospina Flint, 1967 [Costa Rica]	Costa Rica, Panama
Protoptila orotina Flint, 1974 [Costa Rica]	Costa Rica, Panama
Protoptila perdida Bueno-Soria, Santiago-Fragosa & Barba-Alvarez, 2005 [Panama]	Panama
Protoptila rambala Blahnik & Armitage, 2019 [Panama]	Panama
Protoptila spirifera Flint, 1974 [Costa Rica]	Costa Rica, Panama
Protoptila tojana Mosely, 1954 [Mexico]	Costa Rica, Honduras, Mexico, Nicaragua, Panama, Peru
Protoptila totumas Blahnik & Armitage, 2019 [Panama]	Panama
Protoptila trichoglossa Holzenthal & Blahnik, 2006 [Costa Rica]	Costa Rica, Panama

Discussion

Considering that Costa Rica is currently known to host 19 species of *Protoptila* and now shares 12 species with Panama, it is reasonable to predict that at least a few of the remaining species will eventually be found in Panama, particularly in its western highlands. Given that five new species have been described from Panama, four recently, there is also the possibility of additional species from within the country. The lack of affinity for Panama and Costa Rica, with the rest of Central America is most certainly the result of sparse inventory activities in those other countries. As indicated in Blahnik and Armitage (2019), there appears to be preferences by some *Protoptila* species for defined altitudinal ranges. Only time and more collecting will reveal whether the two taxa added here to Panama's fauna are among them.

Acknowledgements

Whereas the majority of the specimens included herein derived from field activities of AIRG at MUPADI, the holotype of the new species was acquired through the PSPSCB Project. We acknowledge the Panamanian Ministry of the Environment, which managed this project with funding from the World Bank, and who provided collecting permits and other support. We thank Tomás A. Ríos González, Edgar Pérez, and Aydeé Cornejo who collectively were involved in the BPPS collections. We also appreciate the organizational and logistical support by the Gorgas Institute and COZEM concerning this project. We are grateful for

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Additional information

Conflict of interest

The authors have declared that no competing interests exist.

Ethical statement

No ethical statement was reported.

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Author contributions

Conceptualization: YPA. Data curation: YPA, BJA. Formal analysis: RJB. Writing and editing (YPA, BJA, RJB). Funding acquisition: BJA.

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Data availability

All of the data that support the findings of this study are available in the main text.

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